

How to Build the KN-Q7 40m SSB Transceiver

Design by BA6BF

Text, drawings and photos by Andrew, ZL2PD

Issue: B

(Website: www.zl2pd.com/index.html)



Introduction

The KN-Q7 is a low power (QRP) transceiver kit designed in China by amateur radio operator BA6BF. Here in New Zealand, we've been one of the first places to receive this kit. It's supplied locally by FutureTech.

Having built the kit, I felt there were a number of areas in which the instructions could be improved. So here's my idea of what the instructions should have looked like!

Disclaimer: I have no association whatsoever with either FutureTech or BA6BF.

Specifications

Frequency Range: 7.050 – 7.072 kHz

Sensitivity: 1uV for 10dB S/N

Power Output: 10W PEP

Supply Voltage: 9-15VDC

Receiver Current: 35 mA typical (32 ohm earphone)

Transmit Current: 2A typical (10 Watts)

Circuit Description

The design follows a standard well-proven approach based on a pair of Philips NE602 mixers. The receiver uses the first mixer, U1, along with a variable crystal oscillator (VCXO), comprising X8, X9 and associated components, to convert a 30 kHz wide segment of the 40m HF amateur band to the IF frequency of 8.467 MHz. The converted signal is filtered in a six-pole crystal ladder filter (X1-X6), and amplified by a Motorola MC1350 amplifier chip, U2. The gain of this stage is controlled by the front panel 'Gain' knob, allowing the signal volume to be varied. The IF signal is demodulated using the second NE602 chip, U3, and the related 8.467 MHz crystal oscillator, X7. The detected audio is then amplified in a TDA2822 audio amplifier chip, U4.

Note: Component designations are taken from the redrawn schematic available from my website either as a PDF or a JPG file.

On transmit, the second mixer (U3) is used to modulate the crystal oscillator X7 with audio from the microphone to generate a Double Sideband (DSB) signal at 8.467 MHz. This signal is passed through the crystal filter again which removes the unwanted sideband leaving the required Lower Sideband (LSB) single sideband (SSB) signal. The first mixer (U1) mixes this signal with the VCXO to generate the required 40m SSB output, at a very low level. The MC1350 IF amplifier (U2) is not used by the transmitter.

To deliver the 10W transmitter output required, the output of the mixer is filtered in a two-pole coupled bandpass filter (L4, L5 etc) and amplified in three stages (Q6, Q7 and Q8)). The output signal is passed through a low pass filter (L6, L7 etc) before being sent to the antenna connector (J3).

Transmit-receive switching is managed by three small relays (K1, K2 and K3) and a pair of small signal transistors (Q2 and Q3). These, in turn, drive a further pair of transistors (Q4 and Q5) which light up the front panel Tx/Rx red/green bicolour light-emitting diode (The bicolour LED contains D7a and D7b).

Construction

The transceiver is built on a single double-sided PCB and housed in a compact two-part extruded aluminium case. Front and back panels are fabricated from screen-printed double sided PCB with overlay labels. The kit (at least, the one I purchased) comes complete with all hardware, including nuts, bolts, washers and screws. Coil wire was also included.

To build the kit, you will need:

- A good quality soldering iron with a fine tip
- Solder (Resin-core only)
- A multimeter (i.e. a digital or analog meter capable of measuring ohms, DC volts, milliamps, amps, etc)

- A 12VDC power supply capable of supplying 2A
- A frequency counter or calibrated receiver – Required to align the transceiver
- The usual array of screwdrivers, alignment tools and...
- Patience

Things I'd recommend include:

- A grid dip (GDO) meter or a signal generator covering 8 – 16 MHz



Figure 1: A grid dip meter - Actually, this is the one I use, along with about 8 plug-in coils to cover from below 1MHz to about 200 MHz.

- An audio tone generator – This is useful for testing some stages. (The one I used is described on my website)
- A dummy load – For first-time builders, this is a 50 ohm non-inductive resistor usually rated anywhere from 5W to 1000W. For this project, a 50 ohm 10W minimum rated load is required. This is connected to the antenna socket when testing the transmitter.

You can easily make one of these. See, for example, the DL1 Wideband 20W Dummy Load from Elecraft (www.elecraft.com). I use eleven ½ W 560 ohm resistors all connected in parallel (to give a 51 ohm load rated at 5W continuous or 10W peak) This is then connected with a short length of coaxial cable to a PL259 plug.



- A watchmaker's eye glass – I use a 4X optical magnifying eyepiece which I find ideal to check the quality of my soldering on this project. It's easy enough to build the board, but you do have to check your soldering to make sure you've not bridged any conductors or connections accidentally. This makes it much easier to see

It's also useful to have an oscilloscope, but it's not essential. Where I suggest using it in these instructions, you may substitute a simple diode RF probe.

To test and operate the transceiver, you will need:

- A microphone with a press-to-talk (PTT) button
- An 8 ohm or 16 ohm speaker
- A 12VDC power supply capable of supplying 2A, and
- An antenna suitable for operation on the 40m band

Of course, you'll need to be a **licensed amateur radio operator**, but, of course, you knew that, right?

The ZL2PD Guide to Making the KN-Q7

These instructions are intended to help in the construction of the kit. I found that the instructions provided in the kit were a bit limited. So, while the transceiver is quite straightforward to build, these instructions are intended to make the task easier. Why repeat my mistakes?

This guide also follows my preferred method of construction – One stage at a time. In this case, the instructions will follow the process I used to build my kit:

1. Parts Inspection and Sorting
2. Surface Mount Devices – 3 chips to be soldered onto the PCB first
3. 8VDC regulator and rear panel sockets – Speaker and DC input
4. Receiver audio
5. Second Mixer and BFO – Doubles as the transmit microphone amplifier and carrier oscillator
6. Transmit-Receive Power Supply Switching
7. Receiver IF Amplifier
8. IF Crystal Filter
9. First Mixer – Includes the Variable Crystal Oscillator (VCXO)
10. Receiver Bandpass Filter
11. Coil Winding
12. First Transmit Amplifier and Transmit Bandpass Filter
13. Second Transmit Amplifier
14. Third (Final) Transmit Amplifier and Low Pass Filter
15. Final Mechanical Assembly

Building the transceiver section by section, and testing each section as soon as you've completed it, allows any faults to be located more quickly. A fault is probably somewhere in that last set of parts you just added. Now, this is in stark contrast to the instructions provided with the kit. It suggest the opposite approach i.e. Build everything all in one go, and then test it. Well, fine. Personally, I find that is not the best approach. A fault can be very tough to find when you've got an entire board of parts and connections to check!

Anyway, I followed my step-by-step approach, and these are the instructions. It worked. But, hey, it's your kit, right? You choose.

The Instructions

Stage 1: Parts Inspection and Sorting

Unpack the kit. Inspect the parts, and compare them against the list of parts to make sure everything has been supplied.



Hint: I sorted the parts out into an cardboard egg carton. It had a dozen places to hold resistors, capacitors (I kept the 100nF capacitors – marked ‘104’ – separate from the rest), semiconductors, inductors, relays, etc. You could also use a muffin tray.

Stage 2: Mount the Surface Mount Devices

Identify the three SMD chips. There are two NE602 mixer ICs and the 2SC3357 transistor (marked ‘RE’). These must be soldered onto the PCB first.

Hint: The kit instructions don’t show which way around the NE602 chips go. The component overlay printed on the PCB, marked ‘602’, shows a notch at one end, but SMD ICs don’t tend to have these notches. If you look really closely, the NE602 has a bevel along one side. (See Figure 2) If you hold the PCB so the notch faces up, then the SMD chip should be mounted so the chip’s beveled edge is on the left-hand side.

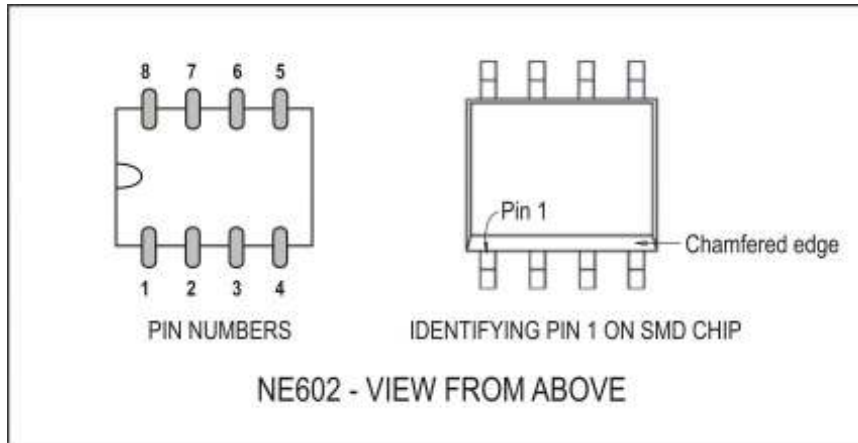


Figure 2: Matching the PCB layout with the NE602 SMD chips

Soldering Surface Mount Devices (SMD)

Soldering these SMD parts is not hard. Just takes some time. Here's how I did it:

Check the orientation of the parts first. Put a small dab of solder onto one of the chip pads on the PCB. Place the chip on the PCB, and hold it gently in place while you touch the tip of your soldering iron onto the IC pin which is sitting on this pad. As soon as the solder melts, pull the soldering iron off the pin.

What should happen is the solder melts, and the solder's surface tension pulls the IC down ever-so-slightly. Check the IC is correctly located and proceed to solder the remaining pins. Then, since the chip is now held by this first pin in just the right position, you can just touch the solder first to each pin, followed by a touch of the soldering iron tip, to each pin in turn, to complete the job.

Of course, life is rarely perfect. The IC may just twist slightly out of alignment as you touch the iron's tip to that first pin. No problem. Just reheat the first pin, and gently press the chip into the right spot. I frequently use a wooden toothpick to help with this step. Once it's back in the right location, solder the remaining pins.

Takes way longer to write this than it does to do the job!

Stage 3: 8VDC regulator, speaker and DC input sockets

Solder the two rear panel DC power and speaker sockets onto the PCB (Ignore the rear panel and the antenna socket until the last stage)

Bend the leads of the 7808 8V regulator IC (See Figure 3) and solder it to the PCB
Solder in C37 and C38 (See Figure 4)

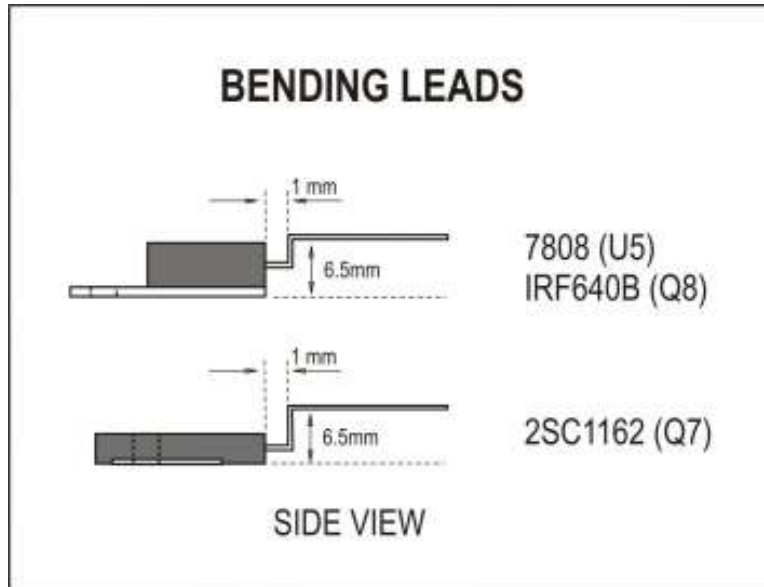


Figure 3: Bending the leads on the power devices must be done carefully to allow the parts to be mounted on the bottom half of the case

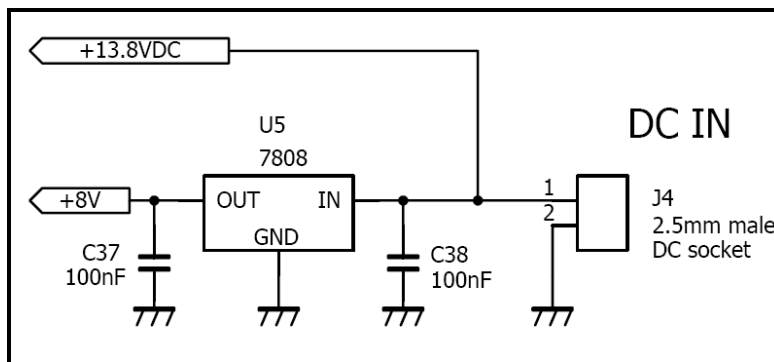


Figure 4: Stage 3 power supply components

Test:

1. Plug in your 12V power supply and use your multimeter to check that 8V is coming out of the regulator.
2. Remove the 12V supply

Stage 4: Audio Amplifier

Solder the TDA2822 audio chip and associated parts into the PCB (Figure 5)

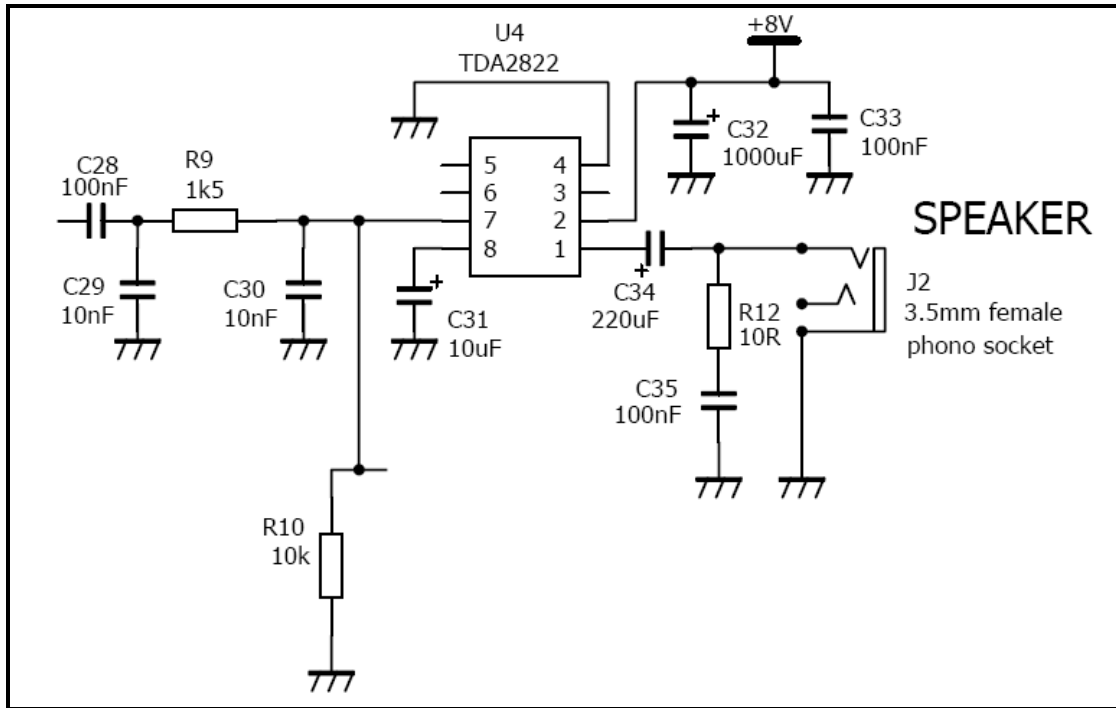


Figure 5: Stage 4 receiver audio components

Note: For the moment, DON'T solder in R11, the 1k5 resistor on the base of Q1, the speaker mute transistor in the audio stage, or Q1 itself, and also omit C36 (100uF). These will be added in Stage 6 (below)

Test: Plug in your speaker, and plug in your 12V power supply (From here on, I'll assume you can remember to turn on the power at the start of each test, and turn it off, and pull out the plug, each time. OK?)

Touch your finger onto the top of some of the components around the TDA2822 chip. You should hear a good loud hum in the speaker when touching some parts, especially the top of R9, the 1k5 resistor going to pin 7, the input pin of the audio amplifier chip.

Stage 5: Second Mixer and BFO

Insert and solder in the components around this section (See Figure 6) including the crystal X7, and the trimmer capacitor, TC1.

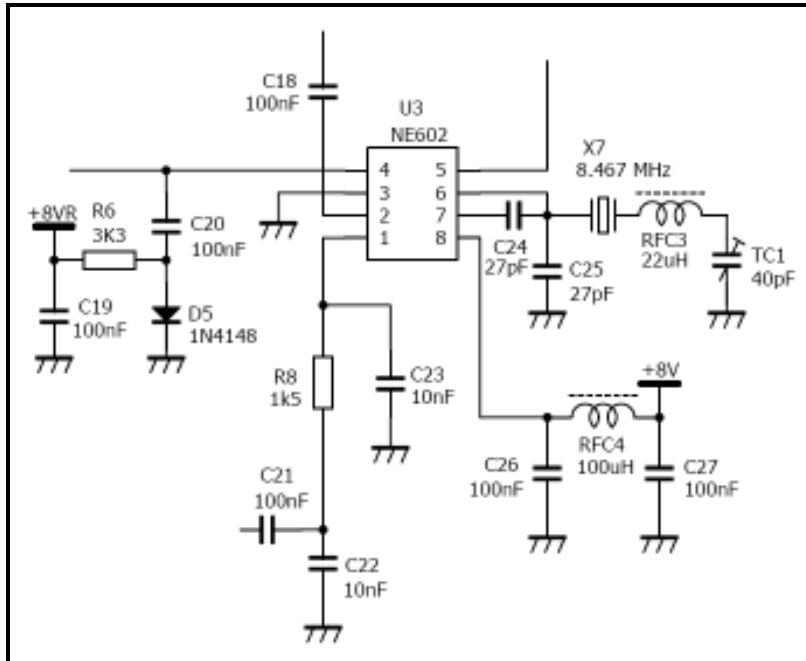


Figure 6: Stage 5 receiver audio components

The trimmer capacitor looks like this:



Test: Plug in the speaker and power supply. You can use either a signal generator or a GDO set to 8.467 MHz to test this stage.

i.e. With a signal generator, use a coaxial cable connected to the output of the generator and ending in a small one or two turn loop made from insulated copper wire, about 10mm (or ½”) in diameter, to couple the output of the generator to the general area of the PCB around the second mixer. With the GDO, hold the coil of the GDO close to the general area of the PCB around the second mixer.

You should hear an audio tone when the signal source is close to this stage. It should vary in tone as the trimmer capacitor is adjusted.

Alignment: Temporarily connect a 10k resistor between pin 7 of this NE602 and ground (i.e. Pin 3 or nearby ground location) Connect a frequency counter to this 10k

resistor. Align the trimmer capacitor using a suitable alignment tool (not a metallic screwdriver) so that the frequency counter displays 8.4655 MHz.

Hint: If you cannot set this easily because the counter is not steady at any stage, it's likely you have some hum or ripple coming from your power supply. Sometimes, adding a 100uF to 1000uF capacitor across the DC lead from the power supply can fix this to permit this test to be carried out successfully.

Remove the 10k resistor once the test is completed.

Stage 6: Transmit-Receive Power Supply Switching

Add Q2, Q3, Q4 and Q5 along with the associated components, including the LED.

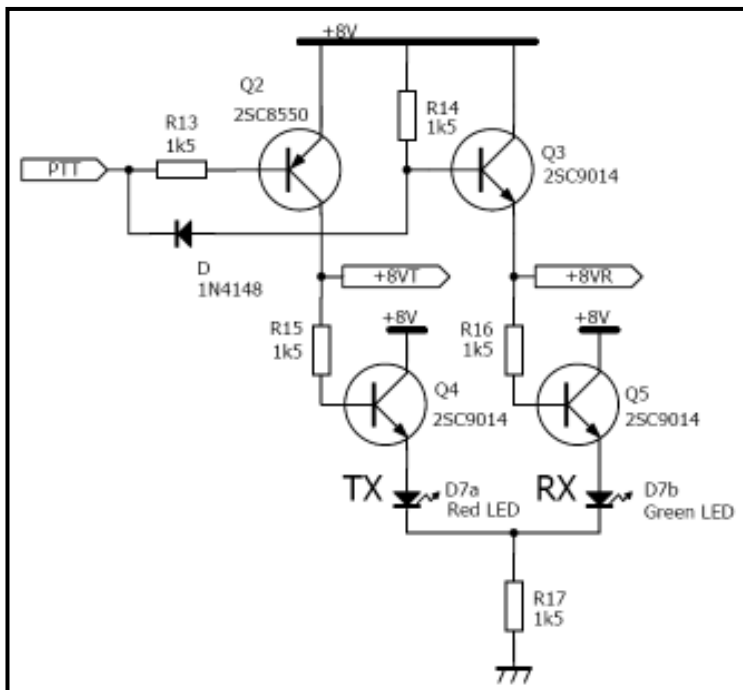


Figure 7: These transistors generate 8V for transmit stages (+8VT) and receiver stages (+8VR)

Important!

Q2 is a PNP transistor, while the other three are NPN transistors. Make sure you fit the '8550' in the right place!

Bend the leads on the LED as shown in Figure 8.

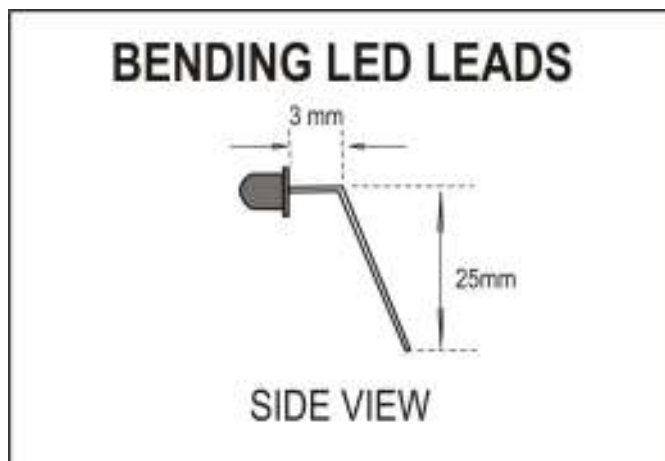


Figure 8: The LED leads must be bent to allow it to fit (later) through the front panel.

Now solder the LED into the PCB. Don't cut any of the LED's leads off – Just push the leads through the PCB far enough to solder them in place. Although it's not shown on the board overlay or detailed in the kit instructions, the **flat** on the side of the LED body should face towards the 'Tune' control. (It doesn't matter if it goes in the other way around by accident. Nothing will get damaged. You'll just see a red light on receive and a green light on transmit)

Test: When power is applied, the LED should glow green. Touch a wire connected between the PCB ground (e.g. the long plated areas on either long edge of the PCB) to the PTT pin on the microphone socket connections close to the front edge of the PCB. This should change the colour of the LED from green to red. Disconnect the wire for now.

Wire up the microphone socket to the PCB temporarily using hookup wire. (You'll have to remove this later to mount the socket on the front panel in the last stage) Plug in a microphone. Plug in the speaker.

Test: Pressing the PTT pressel key on the side of the microphone should also change the LED colour. Talk into the microphone while holding the PTT key down. You should hear your voice coming out of the speaker.

Now solder in R11, the 1k5 resistor on the base of the speaker mute transistor in the audio stage, along with Q1 and C36.

Optional: If you have an oscilloscope, you can test the operation of the first stage of the transmitter. Connect the scope to the relay pin connecting to pin 4 of the second mixer (which is also the DSB generator when in transmit mode) Plug in the microphone, and when transmitting (PTT key down), check for 200 – 400 mVpp (millivolts peak to peak) output while speaking. (This level is only approximate. It may be double this value if the microphone you have has greater output than the one I used)

Stage 7: Receiver IF Amplifier

Solder in the MC1350 and associated parts, including the front panel Gain control.

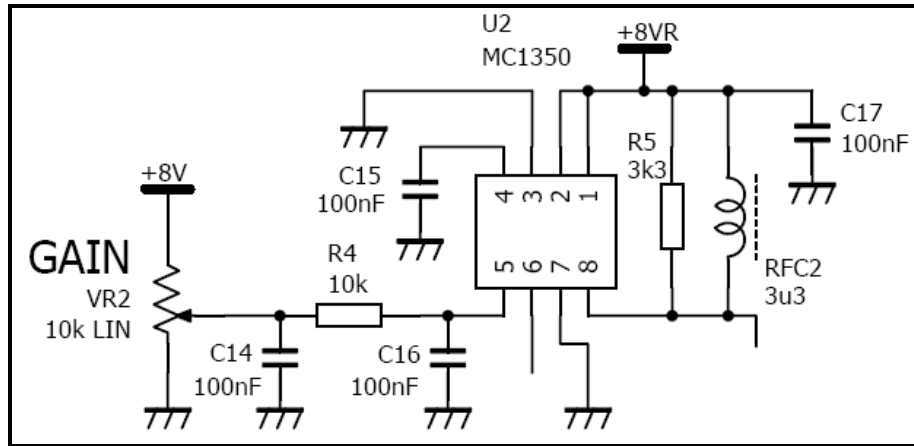


Figure 9: These IF Amplifier components are fitted and tested in this step

I added the Tune control at the same time. Both potentiometers have identical values and can be installed in either location.

Test: Plug in the speaker and power supply, and repeat the signal generator or GDO test from Stage 5. You should hear an audio tone when the signal source is close to this stage. The receiver should be noticeably more sensitive to the signal source than for the previous test in Stage 5. The sensitivity of the stage, and therefore the volume out of the speaker, should also be able to be adjusted by the setting of the front panel 'Gain' control.

Stage 8: IF Crystal Filter

Solder in K2, the relay closest to U2, the MC1350, the six IF filter crystals (X1-X6), and the associated capacitors (C11-C13). All of the 8.467 MHz crystals are identical, and can be used in any location on the PCB marked for these crystals.

Hint: The kit instructions ask you to check that there is no short between crystal connections and the ground. This can be a problem with some types of crystals. Years ago, when faced with this problem in a production setting, they used cellotape. Works really well. In this case, I did the same thing. Use the cheapest cellotape you can find – It's more likely to be narrow i.e. about the same width or slightly wider than the crystals. That saves cutting it to get it to fit.

Cut off a 3 cm length (1¼") and tape it across the top of the board where the IF filter crystals are to be located. Use a pin to push holes through where the crystal pins are meant to go. I needed to do that because the narrow cellotape I used was incredibly strong and it was a bit hard on the crystal pins pushing them through the cellotape.

Now, solder in the crystals. There is no risk of shorting the pins to the ground plane now, and it's amazingly robust. I once saw a twenty year old radio come in for servicing with tape under its crystals. The tape had dried out and gone yellow under the crystals, but it was still doing the job of insulating the case from the PCB tracks running under the crystals.

Hint: Don't forget to add the small 1N4148 diode next to the relay each time you solder in a relay. It's wired across the relay coil and prevents inductive spikes caused by turning off a relay coil from destroying the Tx/Rx DC switching transistors.

Test: Plug in the speaker and power supply, and repeat the signal generator or GDO test from Stage 7. You should hear an audio tone when the signal source is close to the IF filter stage.

Optional: The test just described is not particularly precise. If possible, use an oscilloscope connected to the relay common connection to the input to the filter. Transmit using the microphone. The level out of the IF filter should be about 40 – 100mVpp i.e. about 20% to 30% of the level measured in Stage 6.

Note: I measured a current drain of about 30 mA on receive and 60mA on transmit at this stage.

Stage 9: First Mixer and VCXO

Solder in the components around this stage, including L3, the DIY7-7 coil next to the two crystals, and K1, the relay at the input to the crystal filter. Don't install the two coils used for the receiver preselector bandpass filter just yet (They will be fitted in the next stage of the build)

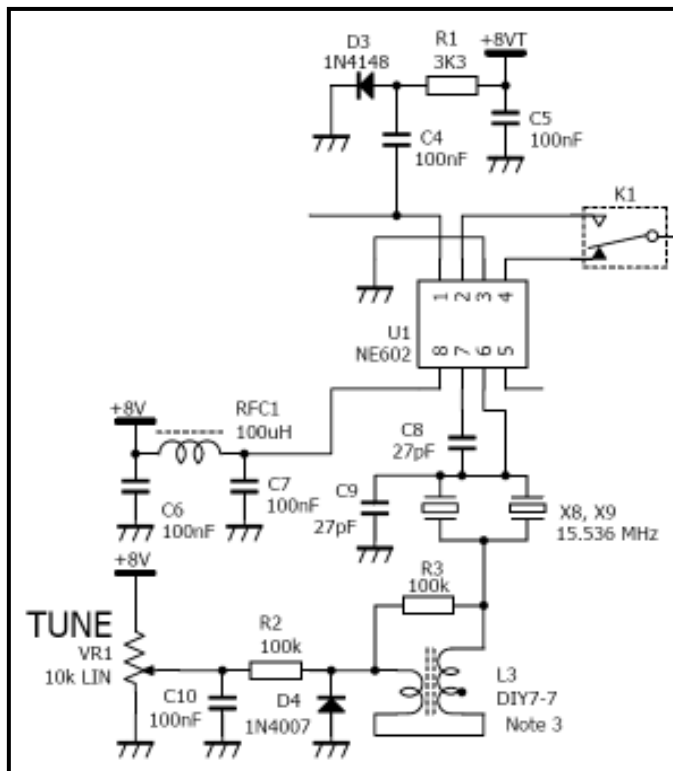


Figure 10: First Mixer and VCXO components

Important!

The DIY7-7 coils are made with an internal capacitor. The VCXO however will not work properly if this capacitor is left fitted in the DIY7-7 in this part of the circuit (i.e. L3). This capacitor is a tiny tubular ceramic capacitor which sits in the base of the coil between the pins. You can see it if you look into the pins at the bottom of any of the coils. Carefully check all the DIY7-7 coils supplied with your kit in case one was supplied **WITHOUT** the capacitor fitted. If so, that's the coil to use for this step of the build.

If all of the DIY7-7 have these capacitors, then you must remove this capacitor from the one to be used for L3. Here's the best way: Use a pair of needle-nosed pliers. Pick the DIY7-7 coil you plan to use for L3, and press one of the sharp points of the pliers hard into the middle of this capacitor. The body of the capacitor will shatter. Shake all the bits out and toss them away. Then, using the pliers again, grab the little wire loops (Not the coil pins!) that comprise the end connections of the capacitor. These are usually the only bits left in the base when you shatter the capacitor. Just tug them out. They will come out quite easily. These wire leads simple snap off inside the coil without breaking anything else. Now your coil is ready to use for L3 in the VCXO.

Test: Plug in the speaker and power supply, and repeat the signal generator or GDO test from Stage 8. However, this time, set your signal generator or GDO to the 7.05 – 7.10 MHz range. You should hear an audio tone when the signal source is close to the first mixer stage. The receiver should, once more, be even more sensitive to the signal source level than in previous tests. Set the signal source so you have a reasonably constant tone from the speaker, and try rotating the Tune control. This should vary the frequency of the tone. (The Tune control adjusts the frequency of the VCXO by varying the voltage across the 1N4007 diode. This changes its capacitance, and hence the frequency the crystals oscillate)

Temporarily connect a 10k resistor between pin 7 of this NE602 and ground (i.e. Pin 3 or nearby ground location) Connect a frequency counter to this 10k resistor. Set the front panel Tune control fully counter-clockwise. Adjust the VCXO coil using a 3mm flat bladed screwdriver or a coil adjustment tool so that the frequency counter displays 15.5155 MHz.

Remove the 10k resistor once the test is completed.

Stage 10: Receiver Bandpass Filter

Install L1 and L2, the two DIY7-7 coils, the associated capacitors forming the receiver bandpass filter, and the two 1N4148 diodes.

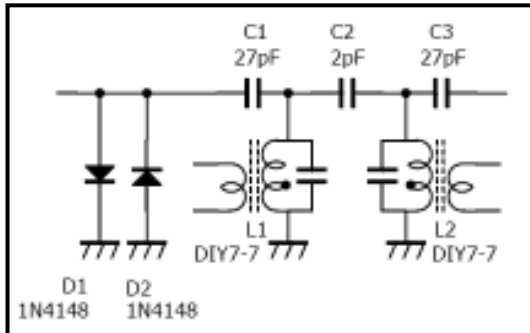


Figure 11: The receiver input bandpass filter components are now installed

Test: Plug in the speaker and power supply, and repeat the signal generator or GDO test from Stage 8. However, this time, set your signal generator or GDO so there is a faint tone audible on the speaker. Adjust the coils using a 3mm flat bladed screwdriver or a coil adjustment tool to maximize the tone's output. As the level increases, reduce the signal generator level or increase the separation between the GDO and the receiver.

Note: Adjusting these coils will require adjustment of one coil, then the other, and back and forth several times, just to achieve the best peak setting.

This completes the receiver!

Stage 11: Coil Winding

Now we come to the part of the build considered by some to be the most difficult – Winding some coils which will be used in the transmitter. I find it one of the easiest stages, personally, and almost relaxing. Just take your time. The following photos illustrate the process.

Firstly, the three transformers (T1, T2 and T3 in the schematic).

For each transformer:

- a) Cut the wire – You will need three lengths of wire, each 20cm long, one for each coil.
- b) Bend each length in half (See Figure 12)



Figure 12: 20 cm of wire bent in half and shown beside a completed transformer

- c) Twist so there are about two or three twists per centimetre of four to five twists per inch.



- d) Leave about 10mm ($\frac{1}{2}$ ") of wire, measured from the start of the wire to the edge of the core, at the start of this step. Now wind five turns onto the core. A turn is counted each time the twisted wire passes through the centre of the toroid core.

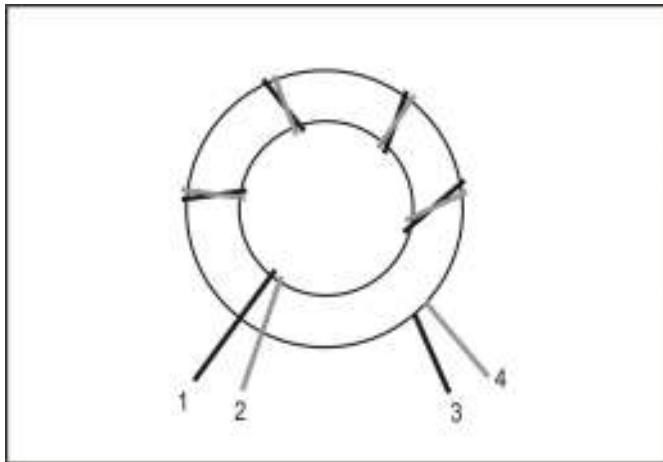


- e) Spread the turns out around the entire toroid core.



- f) Cut the bent end to separate the two windings

- g) Using the ohms or continuity test range of your multimeter, work out which ends are which. Then connect and solder leads 2 and 3 together (See diagram below to identify the leads)



Here are my three completed transformers.



Note: To solder enameled copper wire, scrape the area of the wire to be soldered using a sharp hobby knife. The ends of the coils made here will all require this preparation prior to insertion and soldering in the PCB.

Wind the two large toroids for the low pass filter by cutting two lengths wire each 15 cm long. No twisting of the wire is required. Just wind 12 turns onto each core.



Figure 13: Completed toroid coils L6 and L7 installed in the transceiver PCB

Note: The kit instructions suggest each toroid should require a wire 15 cm long, but I found that wasn't long enough for my coils. I needed about 20cm per coil. I used some wire I had in my workshop because there wasn't quite enough wire in the kit. 24SWG or 26SWG works fine.

Stage 12: First Transmit Amplifier and Transmit Bandpass Filter

Solder in the two DIY7-7 coils for the transmit amplifier, one of the small twisted-wire transformer coils made in the previous step, and the associated parts around the 2SC3357 ("RE") transistor. The required components are shown in Figure 14.

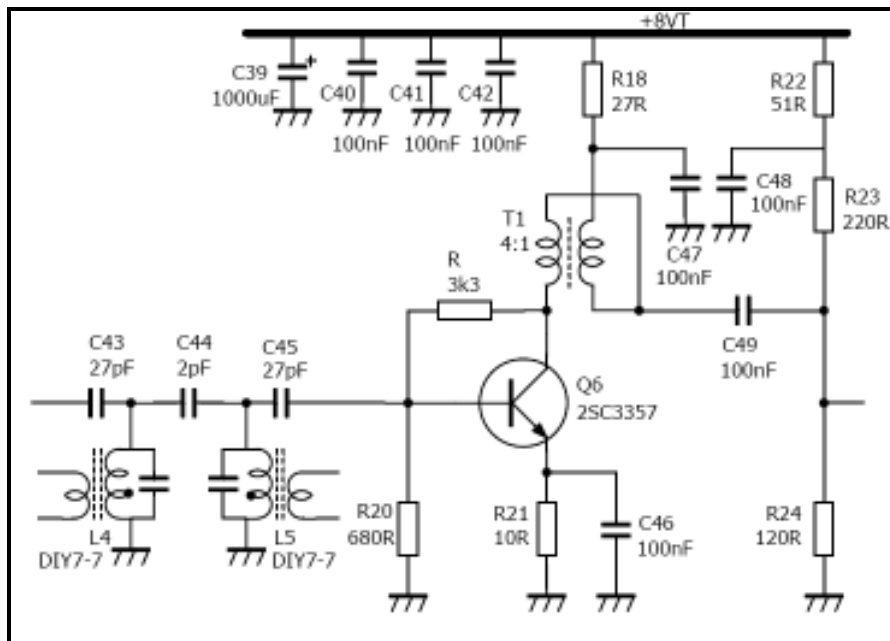


Figure 14: The first transmitter amplifier uses an SMD transistor

Test: This step is difficult to do accurately without an audio oscillator, I think. So, connect an audio oscillator to the microphone connections, and keep the audio output level turned completely down until the test begins. Connect the oscilloscope to the junction of R23, R24 and C49. (R23 and R24 are used as the load for the amplifier stage for this test)

Ground the PTT connection on the microphone connector to start the transmitter. Increase the audio output level into the microphone connections until you can see 50-100mVpp. Now peak the output of this stage by adjusting the two DIY7-7 coils just

mounted. Don't adjust the receiver coils by mistake. Again, like the receiver, adjust one coil, then the other, going back and forth several times, to achieve the maximum output.

Note: Keep the audio generator output level at this setting for now. This will be used in the next two steps.

When I replaced the audio generator with the microphone, microphone speech resulted in 0.5 to 1V_{pp} at this test point on the oscilloscope.

Stage 13: Second Transmit Amplifier

Solder in the second of the three small twisted-wire transformer coils, and the associated parts around the 2SC1162 transistor, shown in Figure 15. Bend the leads of the 2SC1162 (See Figure 2 above) and solder into place.

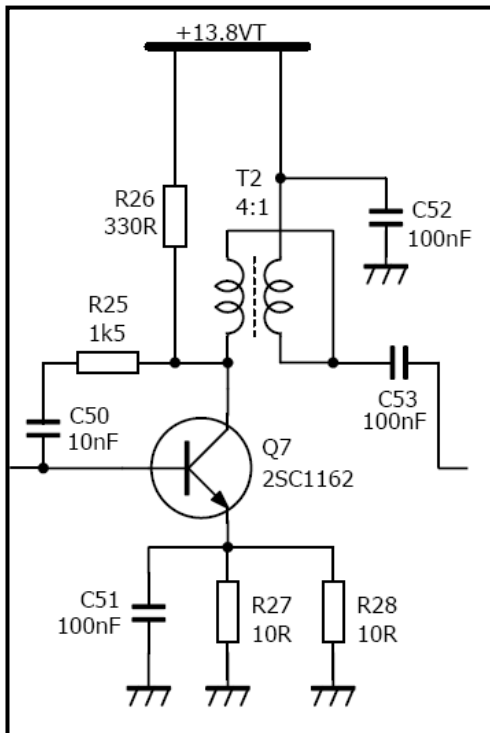


Figure 15: Second transmitter amplifier

Test: Temporarily solder a 50 ohm load between the output of this new stage (from the output of C53, the 100nF capacitor which will connect to the gate of Q8, the IRF640B – this FET should not be installed yet) to ground.

I used two 100 ohm ½ W resistors in parallel. The scope probe can connect across this load.

Important!

During the testing of this stage, do not let the transmitter operate for more than 30 seconds. There is no heatsink on the 2SC1162 transistor, and it can get hot if the PTT is held down for a longer period. After any 30 second transmit burst, if you need to repeat the test, let the transistor cool by leaving the transceiver in receive mode for a minute or so.

Reconnect the audio oscillator to the microphone connector terminals and ground the PTT connection on the microphone connector to start the transmitter. You should see several volts of RF on the scope. I measured a current drain of about 50mA on

transmit. When I replaced the audio generator with the microphone, microphone speech resulted in more than 1.5Vpp at this test point on the oscilloscope.

Stage 14: Third (Final) Transmit Amplifier and Low Pass Filter

Solder in the last of the three small twisted-wire transformer coils, and the associated parts around the IRF640B FET. (See Figure 16) Bend the leads of the IRF640B (See Figure 2 again) and solder into place. Also solder in the two lowpass filter coils L6 and L7 (i.e. the larger toroids).

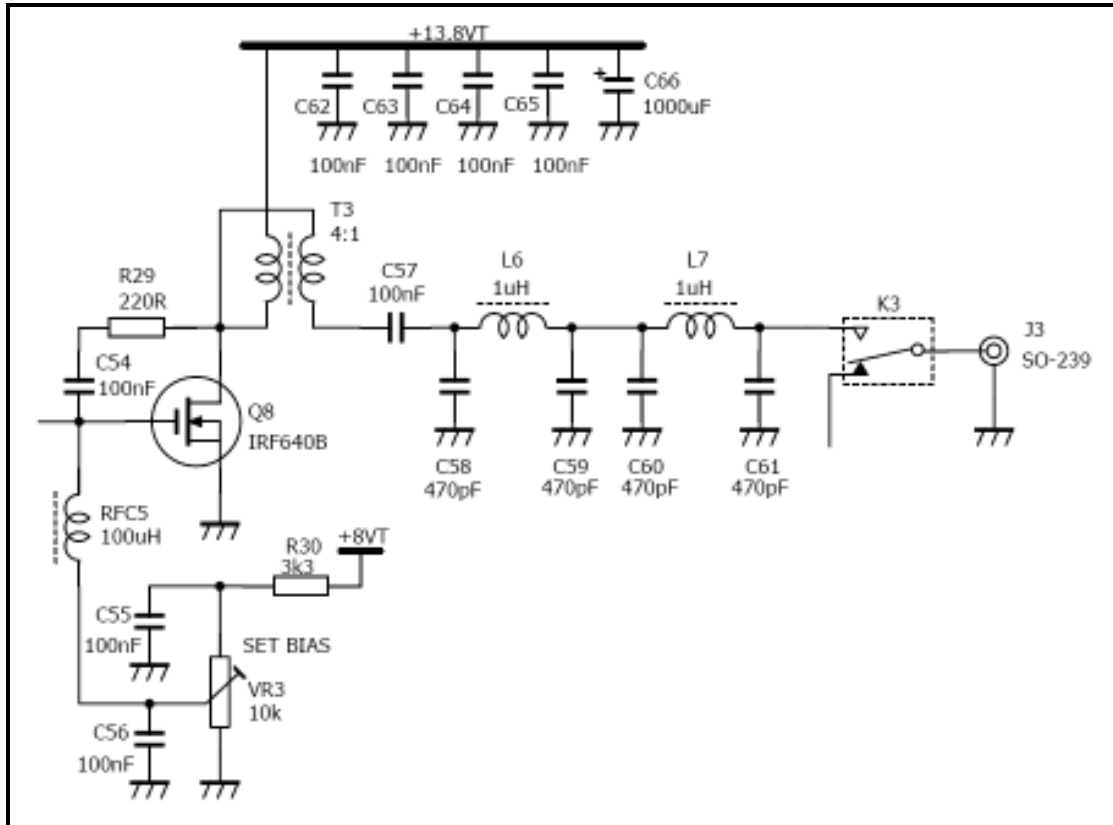


Figure 16: The final power amplifier stage of the transmitter

Before the testing of this last stage can occur, the IRF640B will need a heatsink.

Drill the mounting holes in the base of the case for the three power transistors. To do this, all three transistors must be mounted on the PCB. Slide the PCB into the slot in either half of the case you chose to make the bottom half of the enclosure (Both halves are identical) and position the board so it lies completely within the case. I found there was a gap of about 1mm between the end of my PCB and the end of the case at each end.

Mark the positions for the 3mm holes to be drilled in the base with a hole punch. Remove the PCB and drill the holes, and carefully deburr the holes on the inside of the case. Use a countersinking drill for the countersunk screws used to mount the power devices.



Figure 17: One half of the enclosure has been drilled and is ready to mount the PCB

The 7808 regulator is mounted **without** any insulator pad or insulating washer. The other two devices require both insulation pad and washer. Do not overtighten the nuts and bolts.

Note: I found that the 2SC1162 supplied was a type which did not require the plastic washer. However, it will always require the insulator pad.

Test: With the bottom of the case now acting as the heatsink, temporarily solder the antenna connector to the antenna pads on the PCB using two lengths of hookup wire no longer than about 25mm (1"). Connect a 50 ohm 10W dummy load to the antenna connector. between the output of this new stage (from the output of the 100nF capacitor which will connect to the gate of the IRF640B – this FET should not be installed yet) to ground. I used two 100 ohm ½ W resistors in parallel. The scope probe can connect across this load.

Reconnect the audio oscillator to the microphone connector terminals and ground the PTT connection on the microphone connector to start the transmitter. You should see several volts of RF on the scope. I measured a current drain of about 50mA on transmit. When I replaced the audio generator with the microphone, microphone speech resulted in more than 1.5Vpp at this test point on the oscilloscope.

Stage 15: Final Mechanical Assembly

Mount the microphone socket onto the front panel and mount the coaxial socket to the rear panel. Bolt the front and back panels onto the bottom heatsink. Gently bend the bicolour LED's legs so the LED sits in the hole in the front panel. (My LED was slightly too large to actually fit through the hole, but it's easily visible during operation)

Reconnect the coaxial socket to the antenna connections on the PCB, and the microphone socket to the microphone connections on the front of the PCB.

Note: Only three connections are essential for the microphone: Mic In, PTT In and Ground. Wiring the +8V line to the connector is optional, and may only be required for some powered microphones.

My transceiver is pictured in Figure 18.



Figure 18: The completed transceiver

Important!

The front and back panels in my kit required lots of work to get them to fit properly. Apparently, later kits will fix this problem. The ones supplied will fit, but it's not easy to do it. I managed it by over-drilling each corner hole by 1mm, the holes for the control shafts by the same amount, and using slightly smaller 2.5mm self-tapping screws. No fun!

General Notes on the Kit

Resistor for Electret and Powered Microphones

There is a 10k resistor marked on the PCB (Shown as R7 on my schematic) immediately adjacent to the PCB microphone connections. It allows +8VDC to be supplied to the microphone. This is required for electret microphones, and for some powered microphones.

In my case, I used an Icom IC-HM5 microphone which required this arrangement. Since Icom recommend a 4k7 resistor be used for this microphone, that was the value I fitted, rather than the 10k shown in the schematic. But 10k is likely to be fine for most electret microphones. DO NOT fit this resistor if you are using a standard dynamic microphone.

Non-standard SO-239 Socket

My kit was supplied with an unusual SO-239 antenna socket. It looked just fine, but it would not match any normal PL-259 coaxial plug. According to the kit supplier in New Zealand, FutureTech, the socket supplied with the kit is a Chinese-made metric threaded version of the SO-239. To fix this, I simply threw the original one away and fitted a standard SO-239 socket. Now my KN-Q7 can use all of my PL-259 equipped cables around my shack.

Component Details

I have gathered some specifications on some of the key components in the kit. These were gathered to help me to add some additional features to my transceiver. These are available from my website (www.geocities.com/ZL2PD/index.html).

- DIY7-7 Coils
- NE602
- MC1350
- TDA2822
- 2SC3357
- 2SC1162
- IRF640B

Next Steps

I'm in the process of building some items to match my new KN-Q7 transceiver:

- Antenna tuner
- SWR meter
- Power supply

If I get a bit more time, I'll put the details up on this site.

Enjoy your new transceiver!

73

Andrew, ZL2PD

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